

UNIT 26 Solving Inequalities

CSEC Revision Test

1. Given that $x < 2$ and $x \geq -3$, list the possible values of x when:
- (a) x is an integer (2 marks)
- (b) x is a natural number. (1 mark)
2. (a) Solve the inequality
 $3x - 5 - 5x < 7$, where x is a real number.
- (b) Copy the number line below and draw on it the solution set for the inequality in (a) above.
- $\begin{array}{cccccccccccccccc}
-8 & -7 & -6 & -5 & -4 & -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\
| & | & | & | & | & | & | & | & | & | & | & | & | & | & |
\end{array}$
- (CXC) (4 marks)
3. (a) z is a factor of 24. Give the value of z if $3 < z < 6$. (1 mark)
- (b) y is a multiple of 3. Give the value of y if $3 < y \leq 6$. (1 mark)
4. Find the range of values of n for which $n > 2 - n$. (2 marks)
5. Solve the inequality $x - 1 < 10 - 2x$. (3 marks)
6. Solve the inequality $2x \geq 12$. (CXC) (1 mark)
7. Solve the inequality $2x < 14 < 3x + 5$. (3 marks)
8. (a) Solve for x
 $12 \leq 3x + 5$.
- (b) If x is a member of the set of whole numbers, state the SMALLEST value of x which satisfies the inequality in (a) above.
- (CXC) (3 marks)
9. Solve the inequality
- (i) $x^2 - x - 6 \leq 0$
- (ii) $x^2 - x - 6 \geq 0$ (10 marks)
10. Solve the inequality
 $2x^2 - 9x - 5 < 0$ (4 marks)

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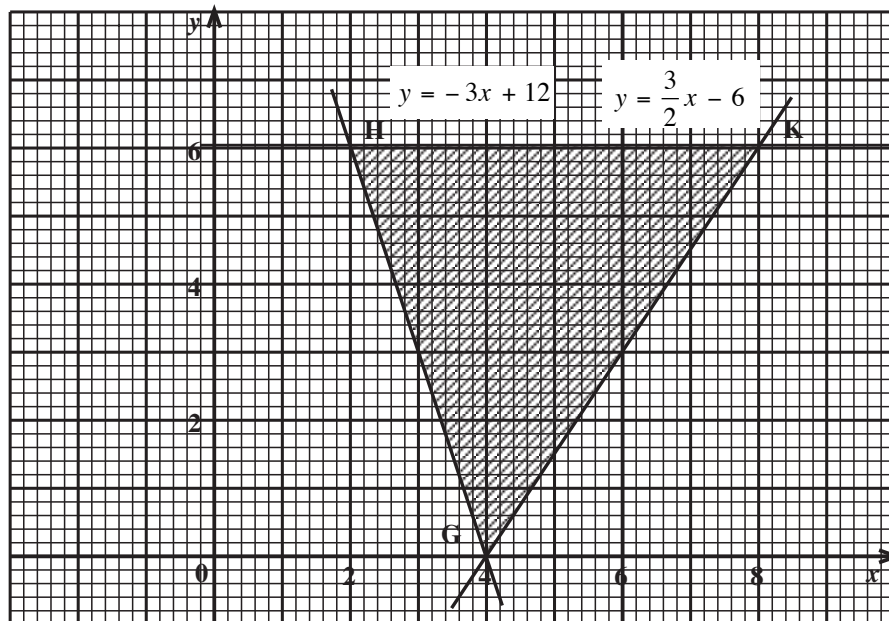
11. (a) Show that the roots of the equation

$$x^2 - 3x - 1 = 0$$

are $\frac{3}{2} \pm \frac{1}{2}\sqrt{13}$. (2 marks)

- (b) Determine the set of values of x for which $x^2 - 1 > 3x$. (3 marks)

12.



The diagram above shows a region bounded by the lines $y = -3x + 12$,

$y = \frac{3}{2}x - 6$ and the line HK.

- (a) Write down the equation of the line HK. (1 mark)
- (b) Write down the set of three inequalities which define the shaded region GHK. (3 marks)

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13. Class 8B has decided to sell apples and bananas at morning break this week to raise money for charity. The profit on each apple is 20 cents, the profit on each banana is 15 cents. They have done some market research and formed the following constraints.
- They will sell at most 800 items of fruit during the week.
 - They will sell at least twice as many apples as bananas.
 - They will sell between 50 and 100 bananas.

Assuming they will sell all their fruit, formulate the above information as a linear programming problem, letting a represent the number of apples they sell and b represent the number of bananas they sell.

Write your constraints as inequalities.

(4 marks)

14. A company is required to make x sockets and y switches in a day.

The numbers of sockets made daily must be at least 50.

- (a) Write an inequality to represent this information.

The number of switches made must be more than 120.

- (b) Write an inequality to represent this information.

Each socket is made from 6 components and each switch is made from 7 components. There are 4200 components available.

- (c) write an inequality to represent this information.

- (d) Using a scale of 1 cm to represent 50 units on each axis, draw a graph and label as S the region which satisfies the three inequalities.

The company makes a profit of \$4 on each socket and \$5 on each switch.

- (e) Write an expression for the profit, $\$P$.
- (f) Use your graph to determine the number of sockets and switches that must be made in a day to obtain maximum profit.
- (g) Calculate this maximum profit.

(13 marks)

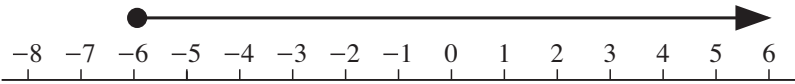
(CXC)

TOTAL MARKS: 61

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ANSWERS

1. (a) $-3, -2, -1, 0, 1$ (one missing: B1) B2 B1
 (b) $0, 1$ B1 (3 marks)
2. (a) $-2x < 12, x > -6$ M1 A1 A1
 (b)  B1 (4 marks)
3. (a) $z = 4$ B1
 (b) $y = 6$ B1 (2 marks)
4. $2n > 2, \text{ so } n > 1$ M1 A1 (2 marks)
5. $x + 2x < 10 + 1, 3x < 11$ M1 A1
 $x < \frac{11}{3}$ B1 (3 marks)
6. $x \geq 6$ B1 (1 mark)
7. $2x < 14 \Rightarrow x < 7$ B1
 $3x + 5 > 14 \Rightarrow 3x > 9 \Rightarrow x > 3$ B1
 i.e. $3 < x < 7$ B1 (3 marks)
8. (a) $3x \geq 7, x \geq \frac{7}{3}$ M1 A1
 (b) 3 B1 (3 marks)
9. (i) $(x - 3)(x + 2) \leq 0$; so $(x - 3) \leq 0$ and $x + 2 \geq 0 \Rightarrow$ M1 A1 A1
 $x \leq 3$ and $x \geq -2 \Rightarrow -2 \leq x \leq 3$
 [or $(x - 3) \geq 0$ and $x + 2 \leq 0 \Rightarrow x \geq 3$ and $x \leq -2$ - no solution]
 Hence solution is $-2 \leq x \leq 3$ A1
- (ii) $(x - 3)(x + 2) \geq 0$ so $(x - 3) \geq 0$ and $(x + 2) \geq 0 \Rightarrow$ M1 A1
 $x \geq 3$ and $x \geq -2 \Rightarrow x \geq 3$ A1
 or $(x - 3) \leq 0$ and $(x + 2) \leq 0 \Rightarrow x \leq 3$ and $x \leq -2$ M1 A1
 $\Rightarrow x \leq -2$ A1
 Hence solution is $x \geq 3$ or $x \leq -2$ A1 (10 marks)

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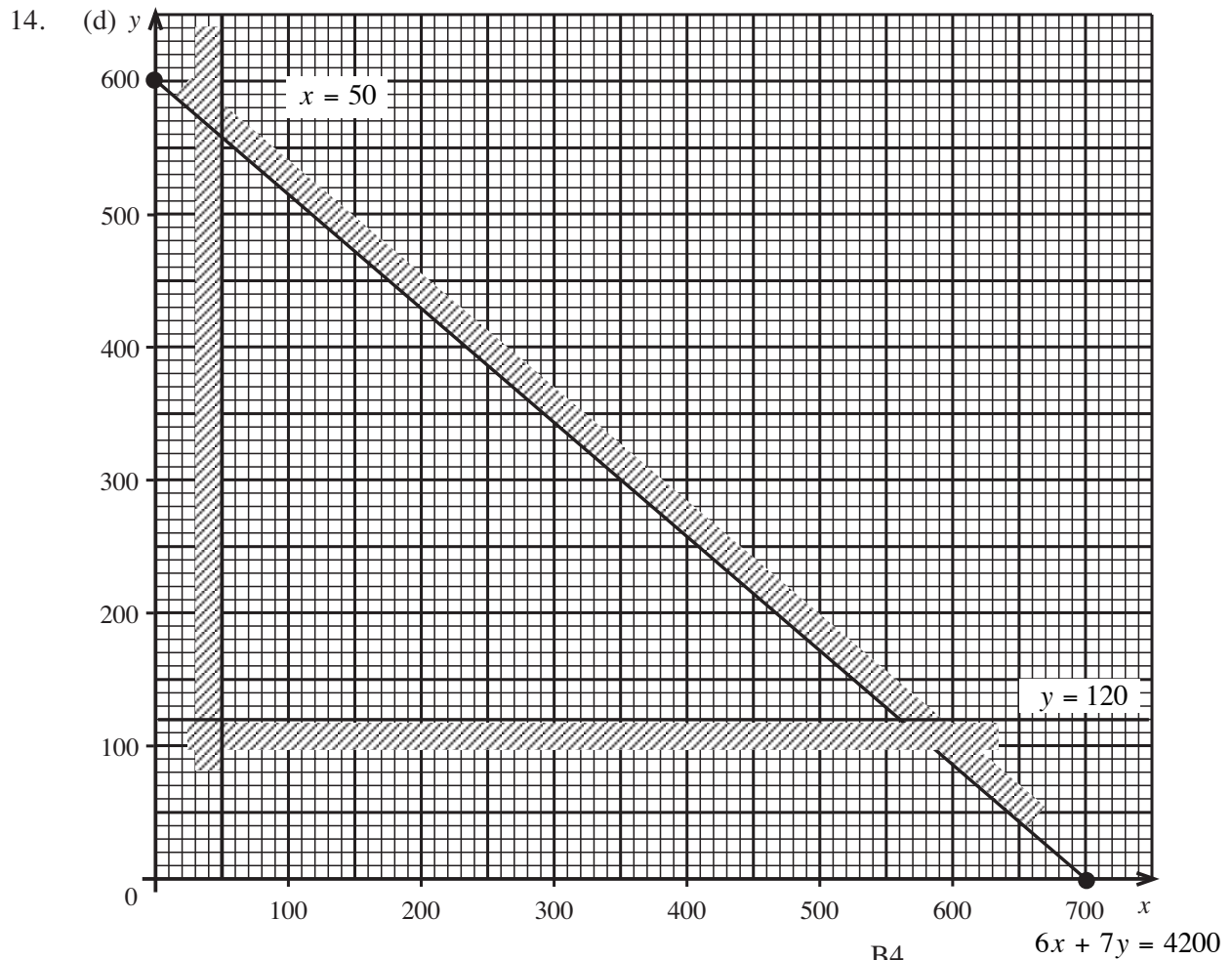
ANSWERS

10. $(2x + 1)(x - 5) < 0$; so M1 A1
- $$2x + 1 > 0 \text{ and } x - 5 < 0 \Rightarrow x > -\frac{1}{2} \text{ and } x < 5 \Rightarrow -\frac{1}{2} < x < 5$$
- A1
- [or $2x + 1 < 0$ and $x - 5 > 0 \Rightarrow x < -\frac{1}{2}$ and $x > 5 \Rightarrow$ no solution]
- Hence solution is $-\frac{1}{2} < x < 5$ A1 (4 marks)
11. (a) $x = \frac{3 \pm \sqrt{9 + 4}}{2} = \frac{3}{2} \pm \frac{1}{2}\sqrt{13}$ M1 A1 (2 marks)
- (b) $\frac{3}{2} - \frac{1}{2} < x < \frac{3}{2} + \frac{1}{2}\sqrt{13}$ M1 A1 A1 (3 marks)
12. (a) $y = 6$ ($2 \leq x \leq 8$) B1
- (b) $y \leq 6$ B1
- $$y \geq \frac{3}{2}x - 6$$
- B1
- $$y \geq -3x + 12$$
- B1 (4 marks)
13. Maximum $P = 20a + 15b$ subject to M1
- $$a + b \leq 800$$
- A1
- $$a \geq 2b$$
- A1
- $$50 \leq b \leq 100$$
- A1 (4 marks)
14. (a) $x \geq 50$ B1
- (b) $y > 120$ B1
- (c) $6x + 7y \leq 4200$ M1 A1

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ANSWERS



B4

(e) $P = 4x + 5y$

B1

(f) Vertices at $(50, 120)$, $(560, 120)$, $(50, \frac{3900}{7})$

M1

Profits are \$800, \$2840, $\$2987\frac{1}{7}$

A1

So maximum profit occurs at $(50, \frac{3900}{7})$ and the nearest integer solution in the feasible region is $(50, 557)$, i.e. 50 sockets and 557 switches.

A1

(g) Profit of \$2985

B1

(13 marks)

TOTAL MARKS: 61